CLAIM AMENDMENTS

Please amend claims 1-2, 5, 36-37, 40, 62-63, 66, 87-88, and 91, and add claims 118-139, all without prejudice, as indicated on the following listing of all the claims in the present application after this Amendment.

1. (currently amended) A method for finding a value of one or more parameters of a diffracting structure wherein a measurement is carried out by directing a polychromatic beam of electromagnetic radiation at said diffracting structure and detecting corresponding ~~intensities or~~ changes in polarization state of a diffraction of said beam at a number of wavelengths from said structure, comprising:

carrying out a measurement of the structure to obtain measured ~~intensities or~~ changes in polarization state of a diffraction from the structure;

providing a set of intensity or change in polarization state data of the diffraction at the wavelengths corresponding to a first set of values of said one or more parameters; and

performing an optimized estimation within a neighborhood of the set of intensity or change in polarization state data using said measured ~~intensities or~~ changes in polarization state to arrive at a second set of values of the one or more parameters.

2. (currently amended) The method of claim 1, wherein said providing includes:

generating a library of sets of ~~intensity or~~ change in polarization state data of the diffraction at the wavelengths, wherein each set of data is generated assuming a corresponding set of values of the one or more parameters, said sets of values of the one or more parameters covering expected ranges of the one or more parameters; and

comparing the measured ~~intensities or~~ changes in polarization state to the sets of data to find the set of ~~intensity or~~ change in polarization state data that corresponds to the first set of values of said one or more parameters.

3. (original) The method of claim 2, wherein said library of sets of values of the one or more parameters covers expected maximum ranges of the one or more parameters.

4. (original) The method of claim 1, wherein said performing performs nonlinear regression.

5. (currently amended) The method of claim 1, further comprising choosing said first set of values of said one or more parameters as a function of sensitivity of said ~~intensity or~~ change in polarization state data to changes in said one or more parameters.

6. (original) The method of claim 5, further comprising choosing said first set of values of said one or more parameters as a function of system noise level.

7. (original) The method of claim 1, wherein the method is adapted for use in controlling a manufacturing parameter, said method further comprising supplying said value found to a manufacturing instrument.

8. (original) The method of claim 7, wherein the method is adapted for use in controlling a semiconductor manufacturing parameter, said method further comprising supplying said value found to a stepper and/or an etcher.

9. (original) A method for finding a value of one or more parameters of a diffracting structure wherein a measurement is carried out by directing a polychromatic beam of electromagnetic radiation at said diffracting structure and detecting corresponding intensities or changes in polarization state of a diffraction of said beam at a number of wavelengths from said structure, comprising:

providing a model to approximate the structure, said model including calculation of eigenvalues;

storing the eigenvalues;

carrying out a measurement of the structure to obtain measured intensities or changes in polarization state of a diffraction from the structure; and

employing the eigenvalues to obtain said value of said one or more parameters of the diffracting structure from the measured intensities or changes in polarization state.

10. (original) The method of claim 9, wherein said diffracting structure comprises layers of the same or different material, wherein said providing provides the model that accounts for the material(s) of the structure.

11. (original) The method of claim 9, wherein said providing provides a multimodal method or a rigorous coupled-wave analysis model.

12. (original) The method of claim 9, wherein said providing provides a rigorous coupled-wave analysis model, said model including calculation of eigenfunctions, and wherein said storing stores also the eigenfunctions.

13. (original) The method of claim 9, said structure comprising a plurality of layers, wherein said providing provides a multi-layered model that includes the propagation of a S-matrix in the layers of the structure, and said storing stores the S-matrix.

14. (original) The method of claim 13, said structure situated on one or more bottom layers, wherein said providing provides a model that includes the propagation of an additional S-matrix in the bottom layers, and said storing stores the additional S-matrix.

15. (original) The method of claim 13, said structure situated below one or more top layers, wherein said providing provides a model that includes the propagation of an additional S-matrix in the top layers, and said storing stores the additional S-matrix.

16. (original) The method of claim 13, wherein said model includes a pile of slabs to approximate the structure, wherein said propagation of the S-matrix includes

calculation of S-matrices for each of the slabs, and wherein said storing stores the S-matrix of at least one of the slabs.

17. (original) The method of claim 16, wherein said storing stores the S-matrices of some of the slabs at or near the bottom of the pile.

18. (original) The method of claim 16, further comprising altering dimensions of one or more slabs at or near the top of the pile to approximate another structure, and re-using the stored S-matrices of some of the slabs at or near the bottom of the pile for obtaining the value of said one or more parameters of the another structure.

19. (original) The method of claim 9, wherein the method is adapted for use in controlling a manufacturing parameter, said method further comprising supplying said value found to a manufacturing instrument.

20. (original) The method of claim 19, wherein the method is adapted for use in controlling a semiconductor manufacturing parameter, said method further comprising supplying said value found to a stepper and/or an etcher.

21. (original) A method for finding a value of one or more parameters of a diffracting structure on or under one or more layers wherein a measurement is carried out by directing a polychromatic beam of electromagnetic radiation at said diffracting structure and detecting corresponding intensities or changes in polarization state of a diffraction of said beam at a number of wavelengths from said structure, comprising:

carrying out a measurement of the structure to obtain measured intensities or changes in polarization state of a diffraction from the structure;

providing one or more sets of intensity or change in polarization state data of the diffraction at the wavelengths corresponding to one or more sets of values of said one or more parameters, wherein the wavelengths of the intensity or change in polarization state data in the one or more sets are chosen as a function of the properties of the one or more layers; and

deriving the value of the one or more parameters of the diffracting structure from the measured intensities or changes in polarization state and the one or more sets of intensity or change in polarization state data.

22. (original) The method of claim 21, wherein said wavelengths of the intensity or change in polarization state data in the one or more sets are chosen to reduce the influence of the properties of the one or more layers on the deriving.

23. (original) The method of claim 22, wherein said wavelengths of the intensity or change in polarization state data in the one or more sets are chosen such that the one or more layers are substantially opaque at said wavelengths.

24. (original) The method of claim 23, further comprising filtering the intensity or change in polarization state data such that the one or more underlying layers are substantially opaque at wavelengths of the filtered intensity or change in polarization state data.

25. (original) The method of claim 21, wherein the method is adapted for use in controlling a manufacturing parameter, said method further comprising supplying said value found to a manufacturing instrument.

26. (original) The method of claim 25, wherein the method is adapted for use in controlling a semiconductor manufacturing parameter, said method further comprising supplying said value found to a stepper and/or an etcher.

27. (original) A method for finding a value of one or more parameters of a diffracting structure wherein a measurement is carried out by directing a polychromatic beam of electromagnetic radiation at said diffracting structure and detecting corresponding intensities or changes in polarization state of a diffraction of said beam at a number of wavelengths from said structure, comprising:

carrying out a measurement of the structure to obtain measured intensities or changes in polarization state of a diffraction from the structure;

providing one or more sets of intensity or change in polarization state data of the diffraction at the wavelengths corresponding to one or more sets of values of said one or more parameters, wherein density of the intensity or change in polarization state data provided at the wavelengths in the one or more sets is chosen as a function of sensitivity of the intensity or change in polarization state data to changes in wavelengths;

deriving the value of the one or more parameters of the diffracting structure from the measured intensities or changes in polarization state and the one or more sets of intensity or change in polarization state data.

28. (original) The method of claim 27, wherein a higher density of intensity or change in polarization state data is taken at wavelengths where such data is more sensitive to changes in wavelengths.

29. (original) The method of claim 27, wherein the method is adapted for use in controlling a manufacturing parameter, said method further comprising supplying said value found to a manufacturing instrument.

30. (original) The method of claim 29, wherein the method is adapted for use in controlling a semiconductor manufacturing parameter, said method further comprising supplying said value found to a stepper and/or an etcher.

~~29~~31. (original) A method for creating a data source useful for finding a value related to one or more parameters of a three-dimensional diffracting structure on a reference plane wherein a measurement is carried out by directing a polychromatic beam of electromagnetic radiation at said diffracting structure and detecting corresponding intensities or changes in polarization state of a diffraction of said beam at a number of wavelengths from said structure, comprising:

providing a model of the structure by cutting a three-dimensional contour resembling a representative portion of the structure along planes parallel to said reference plane to obtain a pile of a plurality of slabs;

forming for each slab a corresponding array of rectangular blocks to approximate such slab, said arrays arranged along planes parallel to the reference plane;

for each of the arrays, performing a multimodal analysis of each block in such array to find its one dimensional solution and matching the solutions of adjacent blocks in such array to find a two-dimensional solution for such array;

obtaining a three-dimensional solution for the contour from the two-dimensional solutions of the arrays for the slabs in the pile.

~~30~~32. (original) The method of claim ~~29~~31, said obtaining comprising calculating diffraction efficiencies of transmitted and reflected radiation from the structure.

~~31~~33. (original) The method of claim ~~29~~31, said three-dimensional diffracting structure comprising a two dimensional array of hills on the reference plane, and wherein said cutting cuts the contour to obtain a pile of cylinders.

~~32~~34. (original) The method of claim ~~29~~31, wherein the method is adapted for use in controlling a manufacturing parameter, said method further comprising supplying said value found to a manufacturing instrument.

~~33~~35. (original) The method of claim ~~32~~34, wherein the method is adapted for use in controlling a semiconductor manufacturing parameter, said method further comprising supplying said value found to a stepper and/or an etcher.

~~34~~36. (currently amended) An apparatus for finding a value of one or more parameters of a diffracting structure wherein a measurement is carried out by directing a polychromatic beam of electromagnetic radiation at said diffracting structure and

detecting corresponding intensities or changes in polarization state of a diffraction of said beam at a number of wavelengths from said structure, comprising:

a system carrying out a measurement of the structure to obtain measured ~~intensities or~~ changes in polarization state of a diffraction from the structure; and

a processor providing a set of ~~intensity or~~ change in polarization state data of the diffraction at the wavelengths corresponding to a first set of values of said one or more parameters, and performing an optimized estimation within a neighborhood of the set of intensity or change in polarization state data using said measured ~~intensities or~~ changes in polarization state to arrive at a second set of values of the one or more parameters.

~~35~~37. (currently amended) The apparatus of claim ~~34~~36, wherein said processor generates a library of sets of ~~intensity or~~ change in polarization state data of the diffraction at the wavelengths, wherein each set of data is generated assuming a corresponding set of values of the one or more parameters, said sets of values of the one or more parameters covering expected ranges of the one or more parameters; and compares the measured ~~intensities or~~ changes in polarization state to the sets of data to find the set of intensity or change in polarization state data that corresponds to the first set of values of said one or more parameters.

~~36~~38. (original) The apparatus of claim ~~35~~37, wherein said library of sets of values of the one or more parameters covers expected maximum ranges of the one or more parameters.

~~37~~39. (original) The apparatus of claim ~~34~~36, wherein said performing performs nonlinear regression or simulated annealing.

~~38~~40. (currently amended) The apparatus of claim ~~34~~36, said processor choosing said first set of values of said one or more parameters as a function of sensitivity of said ~~intensity or~~ change in polarization state data to changes in said one or more parameters.

3941. (original) The apparatus of claim 3840, said processor choosing said first set of values of said one or more parameters as a function of system noise level.

4042. (original) An apparatus for finding a value of one or more parameters of a diffracting structure wherein a measurement is carried out by directing a polychromatic beam of electromagnetic radiation at said diffracting structure and detecting corresponding intensities or changes in polarization state of a diffraction of said beam at a number of wavelengths from said structure, comprising:

a processor providing a model to approximate the structure, said model including calculation of eigenvalues and storing the eigenvalues; and

a system carrying out a measurement of the structure to obtain measured intensities or changes in polarization state of a diffraction from the structure, said processor employing the eigenvalues to obtain said value of said one or more parameters of the diffracting structure from the measured intensities or changes in polarization state.

4143. (original) The apparatus of claim 4042, wherein said diffracting structure comprises layers of the same or different material, wherein said processor provides the model that accounts for the material(s) of the structure.

4244. (original) The apparatus of claim 4042, wherein said processor provides a multimodal apparatus or a rigorous coupled-wave analysis model.

4345. (original) The apparatus of claim 4042, wherein said processor provides a rigorous coupled-wave analysis model, said model including calculation of eigenfunctions, and wherein said processor stores also the eigenfunctions.

4446. (original) The apparatus of claim 4042, said structure comprising a plurality of layers, wherein said processor provides a multi-layered model that includes the propagation of a S-matrix in the layers of the structure, and said storing stores the S-matrix.

4547. (original) The apparatus of claim 4446, said structure situated on one or more bottom layers, wherein said processor provides a model that includes the propagation of an additional S-matrix in the bottom layers, and stores the additional S-matrix.

4648. (original) The apparatus of claim 4446, said structure situated below one or more top layers, wherein said processor provides a model that includes the propagation of an additional S-matrix in the top layers, and stores the additional S-matrix.

4749. (original) The apparatus of claim 4446, wherein said model includes a pile of slabs to approximate the structure, wherein said propagation of the S-matrix includes calculation of S-matrices for each of the slabs, and wherein said processor stores the S-matrix of at least one of the slabs.

4850. (original) The apparatus of claim 4749, wherein said storing stores the S-matrices of some of the slabs at or near the bottom of the pile.

4951. (original) The apparatus of claim 4749, said processor altering dimensions of one or more slabs at or near the top of the pile to approximate another structure, and re-using the stored S-matrices of some of the slabs at or near the bottom of the pile for obtaining the value of said one or more parameters of the another structure.

5052. (original) An apparatus for finding a value of one or more parameters of a diffracting structure on or under one or more layers wherein a measurement is carried out by directing a polychromatic beam of electromagnetic radiation at said diffracting structure and detecting corresponding intensities or changes in polarization state of a diffraction of said beam at a number of wavelengths from said structure, comprising:

a system carrying out a measurement of the structure to obtain measured intensities or changes in polarization state of a diffraction from the structure; and

a processor providing one or more sets of intensity or change in polarization state data of the diffraction at the wavelengths corresponding to one or more sets of values of

said one or more parameters, wherein the wavelengths of the intensity or change in polarization state data in the one or more sets are chosen as a function of the properties of the one or more layers; and deriving the value of the one or more parameters of the diffracting structure from the measured intensities or changes in polarization state and the one or more sets of intensity or change in polarization state data.

~~51~~53. (original) The apparatus of claim ~~50~~52, wherein said wavelengths of the intensity or change in polarization state data in the one or more sets are chosen to reduce the influence of the properties of the one or more layers on the deriving.

~~52~~54. (original) The apparatus of claim ~~51~~53, wherein said wavelengths of the intensity or change in polarization state data in the one or more sets are chosen such that the one or more layers are substantially opaque at said wavelengths.

~~53~~55. (original) The apparatus of claim ~~52~~54, said processor filtering the intensity or change in polarization state data such that the one or more underlying layers are substantially opaque at wavelengths of the filtered intensity or change in polarization state data.

~~54~~56. (original) An apparatus for finding a value of one or more parameters of a diffracting structure wherein a measurement is carried out by directing a polychromatic beam of electromagnetic radiation at said diffracting structure and detecting corresponding intensities or changes in polarization state of a diffraction of said beam at a number of wavelengths from said structure, comprising:

a system carrying out a measurement of the structure to obtain measured intensities or changes in polarization state of a diffraction from the structure; and

a processor providing one or more sets of intensity or change in polarization state data of the diffraction at the wavelengths corresponding to one or more sets of values of said one or more parameters, wherein density of the intensity or change in polarization state data provided at the wavelengths in the one or more sets is chosen as a function of sensitivity of the intensity or change in polarization state data to changes in wavelengths;

and deriving the value of the one or more parameters of the diffracting structure from the measured intensities or changes in polarization state and the one or more sets of intensity or change in polarization state data.

~~55~~57. (original) The apparatus of claim ~~54~~56, wherein a higher density of intensity or change in polarization state data is taken at wavelengths where such data is more sensitive to changes in wavelengths.

~~56~~58. (original) An apparatus for finding a value related to one or more parameters of a three-dimensional diffracting structure wherein a measurement is carried out by directing a polychromatic beam of electromagnetic radiation at said diffracting structure and detecting corresponding intensities or changes in polarization state of a diffraction of said beam at a number of wavelengths from said structure, comprising:

a system carrying out a measurement of the structure to obtain measured intensities or changes in polarization state of a diffraction from the structure; and

a data source that supplies a library of sets of intensity or change in polarization state data of the diffraction at the wavelengths, wherein each set corresponds to a set of values of said one or more parameters, and wherein said library is arrived at by means of a mulitmodal process; and

a processor comparing the measured intensities or changes in polarization state to the library to finding a value related to one or more parameters of the three-dimensional diffracting structure.

~~57~~59. (original) The apparatus of claim ~~56~~58, said structure situated on a reference plane, wherein said process includes:

providing a model of the structure by cutting a three-dimensional contour resembling a representative portion of the structure along planes parallel to said reference plane to obtain a pile of a plurality of slabs;

forming for each slab a corresponding array of rectangular blocks to approximate such slab, said arrays arranged along planes parallel to the reference plane;

for each of the arrays, performing a multimodal analysis of each block in such array to find its one dimensional solution and matching the solutions of adjacent blocks in such array to find a two-dimensional solution for such array; and

obtaining a three-dimensional solution for the contour from the two-dimensional solutions of the arrays for the slabs in the pile.

~~58~~60. (original) A method for detecting line roughness of a surface having grating lines thereon, comprising:

illuminating the surface with radiation in an incidence plane substantially normal to the grating lines, said radiation having only S or P polarization components;

detecting radiation reflected by the surface; and

determining cross-polarization coefficient of the radiation reflected by the surface as an indication of surface line roughness.

V ~~59~~61. (original) An apparatus for detecting line roughness of a surface having grating lines thereon, comprising:

optics illuminating the surface with radiation in an incidence plane substantially normal to the grating lines, said radiation having only S or P polarization components;

a detector detecting radiation reflected by the surface; and

a processor determining cross-polarization coefficient of the radiation reflected by the surface as an indication of surface line roughness.

~~60~~62. (currently amended) A computer readable storage device embodying a program of instructions executable by a computer to perform a method for finding a value of one or more parameters of a diffracting structure wherein a measurement is carried out by directing a polychromatic beam of electromagnetic radiation at said diffracting structure and detecting corresponding intensities or changes in polarization state of a diffraction of said beam at a number of wavelengths from said structure to obtain measured ~~intensities or~~ changes in polarization state of the diffraction from the structure; sad method comprising:

providing a set of ~~intensity or~~ change in polarization state data of the diffraction at the wavelengths corresponding to a first set of values of said one or more parameters; and

performing an optimized estimation within a neighborhood of the set of ~~intensity or~~ change in polarization state data using said measured ~~intensities or~~ changes in polarization state to arrive at a second set of values of the one or more parameters.

~~61~~63. (currently amended) The device of claim ~~60~~62, wherein said providing includes:

generating a library of sets of ~~intensity or~~ change in polarization state data of the diffraction at the wavelengths, wherein each set of data is generated assuming a corresponding set of values of the one or more parameters, said sets of values of the one or more parameters covering expected ranges of the one or more parameters; and

comparing the measured ~~intensities or~~ changes in polarization state to the sets of data to find the set of intensity or change in polarization state data that corresponds to the first set of values of said one or more parameters.

~~62~~64. (original) The device of claim ~~61~~63, wherein said library of sets of values of the one or more parameters covers expected maximum ranges of the one or more parameters.

~~63~~65. (original) The device of claim ~~60~~62, wherein said performing performs nonlinear regression or simulated annealing.

~~64~~66. (currently amended) The device of claim ~~60~~62, said method further comprising choosing said first set of values of said one or more parameters as a function of sensitivity of said ~~intensity or~~ change in polarization state data to changes in said one or more parameters.

~~65~~67. (original) The device of claim ~~64~~66, said method further comprising choosing said first set of values of said one or more parameters as a function of system noise level.

~~66~~68. (original) A computer readable storage device embodying a program of instructions executable by a computer to perform a method for finding a value of one or more parameters of a diffracting structure wherein a measurement is carried out by directing a polychromatic beam of electromagnetic radiation at said diffracting structure and detecting corresponding intensities or changes in polarization state of a diffraction of said beam at a number of wavelengths from said structure to obtain measured intensities or changes in polarization state of the diffraction from the structure; said method comprising:

providing a model to approximate the structure, said model including calculation of eigenvalues;

storing the eigenvalues; and

employing the eigenvalues to obtain said value of said one or more parameters of the diffracting structure from the measured intensities or changes in polarization state.

~~67~~69. (original) The device of claim ~~66~~68, wherein said diffracting structure comprises layers of the same or different material, wherein said providing provides the model that accounts for the material(s) of the structure.

~~68~~70. (original) The device of claim ~~66~~68, wherein said providing provides a multimodal method or a rigorous coupled-wave analysis model.

~~69~~71. (original) The device of claim ~~66~~68, wherein said providing provides a rigorous coupled-wave analysis model, said model including calculation of eigenfunctions, and wherein said storing stores also the eigenfunctions.

~~70~~72. (original) The device of claim ~~66~~68, said structure comprising a plurality of layers, wherein said providing provides a multi-layered model that includes the propagation of a S-matrix in the layers of the structure, and said storing stores the S-matrix.

~~71~~73. (original) The device of claim ~~70~~72, said structure situated on one or more bottom layers, wherein said providing provides a model that includes the propagation of an additional S-matrix in the bottom layers, and said storing stores the additional S-matrix.

~~72~~74. (original) The device of claim ~~70~~72, said structure situated below one or more top layers, wherein said providing provides a model that includes the propagation of an additional S-matrix in the top layers, and said storing stores the additional S-matrix.

~~73~~75. (original) The device of claim ~~70~~72, wherein said model includes a pile of slabs to approximate the structure, wherein said propagation of the S-matrix includes calculation of S-matrices for each of the slabs, and wherein said storing stores the S-matrix of at least one of the slabs.

~~74~~76. (original) The device of claim ~~73~~75, wherein said storing stores the S-matrices of some of the slabs at or near the bottom of the pile.

~~75~~77. (original) The device of claim ~~73~~75, further comprising altering dimensions of one or more slabs at or near the top of the pile to approximate another structure, and re-using the stored S-matrices of some of the slabs at or near the bottom of the pile for obtaining the value of said one or more parameters of the another structure.

~~76~~78. (original) A computer readable storage device embodying a program of instructions executable by a computer to perform a method for finding a value of one or more parameters of a diffracting structure on or under one or more layers wherein a measurement is carried out by directing a polychromatic beam of electromagnetic radiation at said diffracting structure and detecting corresponding intensities or changes in polarization state of a diffraction of said beam at a number of wavelengths from said structure to obtain measured intensities or changes in polarization state of the diffraction from the structure; said method comprising:

providing one or more sets of intensity or change in polarization state data of the diffraction at the wavelengths corresponding to one or more sets of values of said one or more parameters, wherein the wavelengths of the intensity or change in polarization state data in the one or more sets are chosen as a function of the properties of the one or more layers; and

deriving the value of the one or more parameters of the diffracting structure from the measured intensities or changes in polarization state and the one or more sets of intensity or change in polarization state data.

~~77~~79. (original) The device of claim ~~76~~78, wherein said wavelengths of the intensity or change in polarization state data in the one or more sets are chosen to reduce the influence of the properties of the one or more layers on the deriving.

~~78~~80. (original) The device of claim ~~77~~79, wherein said wavelengths of the intensity or change in polarization state data in the one or more sets are chosen such that the one or more layers are substantially opaque at said wavelengths.

~~79~~81. (original) The device of claim ~~78~~80, said method further comprising filtering the intensity or change in polarization state data such that the one or more underlying layers are substantially opaque at wavelengths of the filtered intensity or change in polarization state data.

~~80~~82. (original) A computer readable storage device embodying a program of instructions executable by a computer to perform a method for finding a value of one or more parameters of a diffracting structure wherein a measurement is carried out by directing a polychromatic beam of electromagnetic radiation at said diffracting structure and detecting corresponding intensities or changes in polarization state of a diffraction of said beam at a number of wavelengths from said structure to obtain measured intensities or changes in polarization state of the diffraction from the structure; said method comprising:

providing one or more sets of intensity or change in polarization state data of the diffraction at the wavelengths corresponding to one or more sets of values of said one or more parameters, wherein density of the intensity or change in polarization state data provided at the wavelengths in the one or more sets is chosen as a function of sensitivity of the intensity or change in polarization state data to changes in wavelengths; and

deriving the value of the one or more parameters of the diffracting structure from the measured intensities or changes in polarization state and the one or more sets of intensity or change in polarization state data.

~~81~~83. (original) The device of claim ~~80~~82, wherein a higher density of intensity or change in polarization state data is taken at wavelengths where such data is more sensitive to changes in wavelengths.

~~82~~84. (original) A computer readable storage device embodying a program of instructions executable by a computer to perform a method for providing a data source useful for finding a value of one or more parameters of a diffracting structure on a reference plane wherein a measurement is carried out by directing a polychromatic beam of electromagnetic radiation at said diffracting structure and detecting corresponding intensities or changes in polarization state of a diffraction of said beam at a number of wavelengths from said structure to obtain measured intensities or changes in polarization state of the diffraction from the structure; said method comprising:

providing a model of the structure by cutting a three-dimensional contour resembling a representative portion of the structure along planes parallel to said reference plane to obtain a pile of a plurality of slabs;

forming for each slab a corresponding array of rectangular blocks to approximate such slab, said arrays arranged along planes parallel to the reference plane;

for each of the arrays, performing a multimodal analysis of each block in such array to find its one dimensional solution and matching the solutions of adjacent blocks in such array to find a two-dimensional solution for such array;

obtaining a three-dimensional solution for the contour from the two-dimensional solutions of the arrays for the slabs in the pile.

~~83~~85. (original) The device of claim ~~82~~84, said obtaining comprising calculating diffraction efficiencies of transmitted and reflected radiation from the structure.

~~84~~86. (original) The device of claim ~~82~~84, said three-dimensional diffracting structure comprising a two dimensional array of hills on the reference plane, and wherein said cutting cuts the contour to obtain a pile of cylinders.

~~85~~87. (currently amended) A method for transmitting a program of instructions executable by a computer to perform a process for finding a value of one or more parameters of a diffracting structure wherein a measurement is carried out by directing a polychromatic beam of electromagnetic radiation at said diffracting structure and detecting corresponding intensities or changes in polarization state of a diffraction of said beam at a number of wavelengths from said structure to obtain measured ~~intensities or~~ changes in polarization state of the diffraction from the structure; said method comprising:

causing a program of instructions to be transmitted to a client device, thereby enabling the client device to perform, by means of such program, the following process:

providing a set of ~~intensity or~~ change in polarization state data of the diffraction at the wavelengths corresponding to a first set of values of said one or more parameters; and

performing an optimized estimation within a neighborhood of the set of ~~intensity or~~ change in polarization state data using said measured ~~intensities or~~ changes in polarization state to arrive at a second set of values of the one or more parameters.

~~86~~88. (currently amended) The method of claim ~~85~~87, wherein said providing includes:

generating a library of sets of ~~intensity or~~ change in polarization state data of the diffraction at the wavelengths, wherein each set of data is generated assuming a corresponding set of values of the one or more parameters, said sets of values of the one or more parameters covering expected ranges of the one or more parameters; and

comparing the measured ~~intensities or~~ changes in polarization state to the sets of data to find the set of intensity or change in polarization state data that corresponds to the first set of values of said one or more parameters.

~~87~~89. (original) The method of claim ~~86~~88, wherein said library of sets of values of the one or more parameters covers expected maximum ranges of the one or more parameters.

~~88~~90. (original) The method of claim ~~85~~87, wherein said performing performs nonlinear regression or simulated annealing.

~~89~~91. (currently amended) The method of claim ~~85~~87, said process further comprising choosing said first set of values of said one or more parameters as a function of sensitivity of said ~~intensity or~~ change in polarization state data to changes in said one or more parameters.

~~90~~92. (original) The method of claim ~~89~~91, said process further comprising choosing said first set of values of said one or more parameters as a function of system noise level.

~~91~~93. (original) A method for transmitting a program of instructions executable by a computer to perform a process for finding a value of one or more parameters of a diffracting structure wherein a measurement is carried out by directing a polychromatic beam of electromagnetic radiation at said diffracting structure and detecting corresponding intensities or changes in polarization state of a diffraction of said beam at a number of wavelengths from said structure to obtain measured intensities or changes in polarization state of the diffraction from the structure; said method comprising:

causing a program of instructions to be transmitted to a client device, thereby enabling the client device to perform, by means of such program, the following process:

providing a model to approximate the structure, said model including calculation of eigenvalues;

storing the eigenvalues; and

employing the eigenvalues to obtain said value of said one or more parameters of the diffracting structure from the measured intensities or changes in polarization state.

~~92~~94. (original) The method of claim ~~91~~93, wherein said diffracting structure comprises layers of the same or different material, wherein said providing provides the model that accounts for the material(s) of the structure.

~~93~~95. (original) The method of claim ~~91~~93, wherein said providing provides a multimodal method or a rigorous coupled-wave analysis model.

~~94~~96. (original) The method of claim ~~91~~93, wherein said providing provides a rigorous coupled-wave analysis model, said model including calculation of eigenfunctions, and wherein said storing stores also the eigenfunctions.

~~95~~97. (original) The method of claim ~~91~~93, said structure comprising a plurality of layers, wherein said providing provides a multi-layered model that includes the propagation of a S-matrix in the layers of the structure, and said storing stores the S-matrix.

~~96~~98. (original) The method of claim ~~95~~97, said structure situated on one or more bottom layers, wherein said providing provides a model that includes the propagation of an additional S-matrix in the bottom layers, and said storing stores the additional S-matrix.

~~97~~99. (original) The method of claim ~~95~~97, said structure situated below one or more top layers, wherein said providing provides a model that includes the propagation of an additional S-matrix in the top layers, and said storing stores the additional S-matrix.

~~98~~100. (original) The method of claim ~~95~~97, wherein said model includes a pile of slabs to approximate the structure, wherein said propagation of the S-matrix includes

calculation of S-matrices for each of the slabs, and wherein said storing stores the S-matrix of at least one of the slabs.

~~99~~101. (original) The method of claim ~~98~~100, wherein said storing stores the S-matrices of some of the slabs at or near the bottom of the pile.

~~100~~102. (original) The method of claim ~~99~~101, further comprising altering dimensions of one or more slabs at or near the top of the pile to approximate another structure, and re-using the stored S-matrices of some of the slabs at or near the bottom of the pile for obtaining the value of said one or more parameters of the another structure.

~~101~~103. (original) A method for transmitting a program of instructions executable by a computer to perform a process for finding a value of one or more parameters of a diffracting structure on or under one or more layers wherein a measurement is carried out by directing a polychromatic beam of electromagnetic radiation at said diffracting structure and detecting corresponding intensities or changes in polarization state of a diffraction of said beam at a number of wavelengths from said structure to obtain measured intensities or changes in polarization state of the diffraction from the structure; said method comprising:

causing a program of instructions to be transmitted to a client device, thereby enabling the client device to perform, by means of such program, the following process:

providing one or more sets of intensity or change in polarization state data of the diffraction at the wavelengths corresponding to one or more sets of values of said one or more parameters, wherein the wavelengths of the intensity or change in polarization state data in the one or more sets are chosen as a function of the properties of the one or more layers; and

deriving the value of the one or more parameters of the diffracting structure from the measured intensities or changes in polarization state and the one or more sets of intensity or change in polarization state data.

~~102~~104. (original) The method of claim ~~101~~103, wherein said wavelengths of the intensity or change in polarization state data in the one or more sets are chosen to reduce the influence of the properties of the one or more layers on the deriving.

~~103~~105. (original) The method of claim ~~102~~104, wherein said wavelengths of the intensity or change in polarization state data in the one or more sets are chosen such that the one or more layers are substantially opaque at said wavelengths.

~~104~~106. (original) The method of claim ~~103~~105, said process further comprising filtering the intensity or change in polarization state data such that the one or more underlying layers are substantially opaque at wavelengths of the filtered intensity or change in polarization state data.

~~105~~107. (original) A method for transmitting a program of instructions executable by a computer to perform a process for finding a value of one or more parameters of a diffracting structure wherein a measurement is carried out by directing a polychromatic beam of electromagnetic radiation at said diffracting structure and detecting corresponding intensities or changes in polarization state of a diffraction of said beam at a number of wavelengths from said structure to obtain measured intensities or changes in polarization state of the diffraction from the structure; said method comprising:

causing a program of instructions to be transmitted to a client device, thereby enabling the client device to perform, by means of such program, the following process:

providing one or more sets of intensity or change in polarization state data of the diffraction at the wavelengths corresponding to one or more sets of values of said one or more parameters, wherein density of the intensity or change in polarization state data provided at the wavelengths in the one or more sets is chosen as a function of sensitivity of the intensity or change in polarization state data to changes in wavelengths; and

deriving the value of the one or more parameters of the diffracting structure from the measured intensities or changes in polarization state and the one or more sets of intensity or change in polarization state data.

~~106~~108. (original) The method of claim ~~105~~107, wherein a higher density of intensity or change in polarization state data is taken at wavelengths where such data is more sensitive to changes in wavelengths.

~~107~~109. (original) A method for transmitting a program of instructions executable by a computer to perform a process for finding a value of one or more parameters of a diffracting structure on a reference plane wherein a measurement is carried out by directing a polychromatic beam of electromagnetic radiation at said diffracting structure and detecting corresponding intensities or changes in polarization state of a diffraction of said beam at a number of wavelengths from said structure to obtain measured intensities or changes in polarization state of the diffraction from the structure; said method comprising:

causing a program of instructions to be transmitted to a client device, thereby enabling the client device to perform, by means of such program, the following process:

providing a model of the structure by cutting a three-dimensional contour resembling a representative portion of the structure along planes parallel to said reference plane to obtain a pile of a plurality of slabs;

forming for each slab a corresponding array of rectangular blocks to approximate such slab, said arrays arranged along planes parallel to the reference plane;

for each of the arrays, performing a multimodal analysis of each block in such array to find its one dimensional solution and matching the solutions of adjacent blocks in such array to find a two-dimensional solution for such array;

obtaining a three-dimensional solution for the contour from the two-dimensional solutions of the arrays for the slabs in the pile.

~~108~~110. (original) The method of claim ~~107~~109, said obtaining comprising calculating diffraction efficiencies of transmitted and reflected radiation from the structure.

~~109~~111. (original) The method of claim ~~107~~109, said three-dimensional diffracting structure comprising a two dimensional array of hills on the reference plane, and wherein said cutting cuts the contour to obtain a pile of cylinders.

~~110~~112. (original) An apparatus for finding and using a value of one or more parameters of a diffracting structure of a sample wherein a measurement is carried out by directing a polychromatic beam of electromagnetic radiation at said diffracting structure and detecting corresponding data of a diffraction of said beam from said structure, comprising:

a system carrying out a measurement of the structure to obtain measured data of a diffraction from the structure; and

a processor using said measured data to arrive at a set of value(s) of the one or more parameters; and

an instrument processing the sample according to one or more processing parameters, said instrument altering said one or more processing parameters in response to the set of value(s).

~~111~~113. (original) The apparatus of claim ~~110~~112, wherein said instrument includes a stepper and/or an etcher.

~~112~~114. (original) The apparatus of claim ~~110~~112, wherein said data includes intensities or changes in polarization state information.

~~113~~115. (original) The apparatus of claim ~~110~~112, wherein said data includes data points at a number of wavelengths.

~~114~~116. (original) A method for finding and using a value of one or more parameters of a diffracting structure of a sample wherein a measurement is carried out by directing a polychromatic beam of electromagnetic radiation at said diffracting structure and detecting corresponding data of a diffraction of said beam from said structure, comprising:

carrying out a measurement of the structure to obtain measured data of a diffraction from the structure; and

using said measured data to arrive at a set of value(s) of the one or more parameters; and

processing the sample according to one or more processing parameters, said processing including altering said one or more processing parameters in response to the set of value(s).

~~115~~117. (original) The method of claim ~~114~~116, wherein said processing employs a stepper and/or an etcher.

118. (new) A method for finding a value of one or more parameters of a diffracting structure wherein a measurement is carried out by directing a polychromatic beam of electromagnetic radiation at said diffracting structure and detecting corresponding changes in polarization state of a diffraction of said beam at a number of wavelengths from said structure, comprising:

carrying out a measurement of the structure to obtain measured intensity or change in polarization state of a diffraction from the structure;

providing a set of intensity or change in polarization state data of the diffraction at the wavelengths corresponding to a first set of values of said one or more parameters, said providing including obtaining a coarse library of sets of diffraction data at different wavelengths with corresponding sets of values of the parameters at a coarse resolution; and

performing an optimized estimation within a neighborhood of the set of intensity or change in polarization state data using said measured change in polarization state to arrive at a second set of values of the one or more parameters at a resolution finer than the coarse resolution.

119. (new) The method of claim 118, wherein said providing includes:

generating a library of sets of intensity or change in polarization state data of the diffraction at the wavelengths, wherein each set of data is generated assuming a

corresponding set of values of the one or more parameters, said sets of values of the one or more parameters covering expected ranges of the one or more parameters; and

comparing the measured changes in polarization state to the sets of data to find the set of intensity or change in polarization state data that corresponds to the first set of values of said one or more parameters.

120. (new) The method of claim 119, wherein said library of sets of values of the one or more parameters covers expected maximum ranges of the one or more parameters.

121. (new) The method of claim 118, wherein said performing performs nonlinear regression.

122. (new) The method of claim 118, further comprising choosing said first set of values of said one or more parameters as a function of sensitivity of said intensity or change in polarization state data to changes in said one or more parameters.

123. (new) The method of claim 122, further comprising choosing said first set of values of said one or more parameters as a function of system noise level.

124. (new) The method of claim 118, wherein the method is adapted for use in controlling a manufacturing parameter, said method further comprising supplying said value found to a manufacturing instrument.

125. (new) The method of claim 124, wherein the method is adapted for use in controlling a semiconductor manufacturing parameter, said method further comprising supplying said value found to a stepper and/or an etcher.

126. (new) The method of claim 9, further comprising interpolating between eigenvalues wherein said employing employs the interpolated eigenvalues to obtain said value of said one or more parameters of the diffracting structure.

127. (new) An apparatus for finding a value of one or more parameters of a diffracting structure wherein a measurement is carried out by directing a polychromatic beam of electromagnetic radiation at said diffracting structure and detecting corresponding changes in polarization state of a diffraction of said beam at a number of wavelengths from said structure, comprising:

a system carrying out a measurement of the structure to obtain measured intensity or change in polarization state of a diffraction from the structure;

a processor providing a set of intensity or change in polarization state data of the diffraction at the wavelengths corresponding to a first set of values of said one or more parameters, said processor obtaining a coarse library of sets of diffraction data at different wavelengths with corresponding sets of values of the parameters at a coarse resolution, and performing an optimized estimation within a neighborhood of the set of intensity or change in polarization state data using said measured change in polarization state to arrive at a second set of values of the one or more parameters at a resolution finer than the coarse resolution.

128. (new) The apparatus of claim 127, wherein said processor generates a library of sets of intensity or change in polarization state data of the diffraction at the wavelengths, wherein each set of data is generated assuming a corresponding set of values of the one or more parameters, said sets of values of the one or more parameters covering expected ranges of the one or more parameters; and the processor compares the measured changes in polarization state to the sets of data to find the set of intensity or change in polarization state data that corresponds to the first set of values of said one or more parameters.

129. (new) The apparatus of claim 128, wherein said library of sets of values of the one or more parameters covers expected maximum ranges of the one or more parameters.

130. (new) The apparatus of claim 127, said processor performs nonlinear regression.

131. (new) The apparatus of claim 127, wherein said processor chooses said first set of values of said one or more parameters as a function of sensitivity of said intensity or change in polarization state data to changes in said one or more parameters.

132. (new) The apparatus of claim 131, wherein said processor chooses said first set of values of said one or more parameters as a function of system noise level.

133. (new) The apparatus of claim 127, wherein the apparatus controls a manufacturing parameter, said processor supplying said value found to a manufacturing instrument.

134. (new) The apparatus of claim 133, wherein the apparatus is adapted for use in controlling a semiconductor manufacturing parameter, said processor supplying said value found to a stepper and/or an etcher.

135. (new) The apparatus of claim 42, wherein the processor interpolates between eigenvalues and employs the interpolated eigenvalues to obtain said value of said one or more parameters of the diffracting structure.

136. (new) The method of claim 1, wherein said carrying carries out measurement to obtain measured intensities of the diffraction from the structure, said providing provides a set of intensity data of the diffraction at the wavelengths corresponding to the first set of values of said one or more parameters, and said performing performs an optimized estimation within a neighborhood of the set of

intensity data using said measured intensities to arrive at the second set of values of the one or more parameters.

137. (new) The apparatus of claim 36, wherein said system carries out measurement to obtain measured intensities of the diffraction from the structure, and said processor provides a set of intensity data of the diffraction at the wavelengths corresponding to the first set of values of said one or more parameters and performs an optimized estimation within a neighborhood of the set of intensity data using said measured intensities to arrive at the second set of values of the one or more parameters.

138. (new) The device of claim 62, wherein the measurement also obtains measured intensities of the diffraction from the structure, and wherein said providing provides a set of intensity data of the diffraction at the wavelengths corresponding to the first set of values of said one or more parameters, and said performing performs an optimized estimation within a neighborhood of the set of intensity data using said measured intensities to arrive at the second set of values of the one or more parameters.

139. (new) The method of claim 87, wherein the measurement also obtains measured intensities of the diffraction from the structure, and wherein said providing provides a set of intensity data of the diffraction at the wavelengths corresponding to the first set of values of said one or more parameters, and said performing performs an optimized estimation within a neighborhood of the set of intensity data using said measured intensities to arrive at the second set of values of the one or more parameters.